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ABSTRACT

To determine reasons for the difficulties reading disabled boys commonly have with memory tasks, an investigation of the use of category organization in free recall of such children was undertaken. The performance of 45 nine- to eleven-year-old normal and 45 reading disabled boys was compared on a free recall task in which stimulus items were arranged in a fixed order for presentation prior to recall. Subsequently, subjects experienced one of three manipulations, all involving the active sorting of the materials. Two of these manipulations attempted through instructions to affect the child's level of processing of items, while the third allowed the child to sort freely in preparation for recall. Poor readers recalled fewer items and tended to show less organization of recall than normal children during the baseline trial. On the experimental trial, recall and category clustering were highest for both groups following a manipulation designed to produce semantic encoding and grouping of items, and lowest when the children were required to focus on the color of the items. In the absence of instructions to guide the nature of their sorting of items for study, the reading disabled children failed to organize or study as effectively as normal readers did. Rather than lacking the ability to use semantic relations as a strategy for grouping items, the reading disabled children had difficulty in spontaneously generating an effective grouping strategy to aid recall. (Author)

Free Recall in Normal and Poor Readers as a Function of Task Manipulations

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Footnote

A report of this research was given at the biennial meeting of the Society for Research in Child Development, San Francisco, March, 1979. The paper is based on a dissertation submitted by the first author to the Graduate School of Tulane University, in partial fulfillment of the requirements for the Ph. D. The second author served as dissertation advisor. We would like to thank members of the dissertation committee, particularly Professors William P. Dunlap and Chizuko Izawa, for their contributions to the design and execution of the study. Appreciation is extended to the Director of Research and Evaulation of the New Orleans Public Schools for granting permission to carry out the research, and to the principals, teachers, and children at participating schools for their cooperation. The Coordenancao do Aperfeicoamento de Pessoal de Nivel Superior (CAPES) provided financial support for Dr. Dallago's study at Tulane University. She is now a member of the faculty of the Departmento de Educacao of the Universidade Federal do Ceara, Fortaleza, Ceara, Brazil.

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Abstract

The use of category organization in free recall of reading disabled boys was investigated, in an attempt to determine reasons for the difficulties such children commonly have with memory tasks. The performance of 9- to 11-year-old normal and reading disabled boys was compared on a baseline free recall task in which the stimulus items (colored pictures of common objects) were arranged in a fixed order for presentation and study prior to recall. Subsequently, subjects experienced one of three manipulations, all involving the active sorting of stimulus materials. Two of these attempted through instructions to affect the child's level of processing of items, while the third allowed the child to sort freely in preparation for recall. Poor readers recalled less items and tended to show less organization of recall than normals during the baseline trial. On the experimental trial, recall and category clustering were highest for both groups following a manipulation designed to produce semantic encoding and grouping of items, and lowest when the children were required to focus on the color of the items. In the absence of instructions to guide the nature of their sorting of items for study, the reading disabled children failed to organize or study as effectively as normal readers did. Rather than lacking the ability to use semantic relations as a strategy for grouping items in recall, the reading disabled had difficulty in spontaneously generating an effective grouping strategy to aid recall.

Free Recall in Normal and Poor [redacted]

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Research in children's memory has recently be[redacted]nded to populations of children showing developmental disabilities (Campione & Brown, 1977; Torgeson, 1975). In particular, investigators concerned with describing problems of learning disabled children have come to focus on memory skills as an area of potential deficit. The present study compares normal and poor readers' performance in free recall tasks administered under varying instructional conditions, in order to learn more about the memory abilities and deficiencies of poor readers.

A "learning disability" is generally viewed as a retardation in the child's ability to demonstrate knowledge of academic subject matter at a level commensurate with his or her intellectual ability (Hallahan & Kauffman, 1976). A specific index commonly used to distinguish the learning disabled child is his or her discrepant level of reading proficiency. This definition was used to characterize the group of children tested in the present study.

Interest in memory dysfunctions of learning disabled children has been sparked by a number of studies demonstrating difficulties these children have with a variety of verbal memory tasks (Katz & Keutsch, 1967; Kluever, 1971; Ring, 1975; Senf & Freundl, Note 1). A memory deficit may be interpreted in at least two ways: some investigators (e.g., Freston & Drew, 1974; Parker, Freston, & Drew, 1975) have implied that learning disabled children suffer structural deficiencies that contribute to pervasive and persistent lacks in memory skill. On the other hand, Torgeson (1975) and others have proposed that learning disabled children perform poorly on memory tasks because of

their inability or lack of inclination to develop and use efficient mnemonic strategies. Brown (1974) has made a similar argument in regard to memory task performance of mentally retarded children. She has further suggested that such children can use strategies effectively when given explicit and appropriate training in their use.

Evidence for the absence or ineffective use of mnemonic strategies in poor readers has been obtained for the use of verbal rehearsal in serial recall tasks (Bauer, 1977; Torgeson & Goldman, 1977). Research on organizational strategies employed by reading disabled children in free recall is still somewhat limited. A number of studies have demonstrated that these children remember less items in a free recall task than do children who have demonstrated average or above-average reading skills (Freston & Drew, 1974; Parker, et al., 1975; Torgeson, 1977; Wong, Wong, & Foth, 1977). Differences in the use of strategies that might account for recall deficits are still somewhat elusive. For example, Wong, et al. (1977) found that poor readers showed less category clustering in recall than normal readers did, but Torgeson (1977) did not find such a difference, although he did find that poor readers showed less semantic grouping of items during a study period preceding recall than did normal readers of the same age level. In both of these studies, reading disabled children verbalized about the items less than normals did while studying in preparation for recall. Torgeson also found that poor readers showed much more "distracted" behavior than normals. Thus, differences in recall performance of good and poor readers may be due to deficiencies in the use of effective organizational strategies, or may simply be due to the inability of the reading disabled to concentrate effectively on the task.

Both Torgeson (1977) and Wong, et al. (1977) used experimental manipulations in efforts to improve the recall performance of poor readers. Torgeson found that with a strong set of instructions about the use of category organization in study and recall, reading-disabled children's free recall performance increased more than that of the normal readers tested, so that the two groups became very similar in recall performance. Wong, et al., on the other hand, using a between-subjects design to evaluate the effect of a category cuing procedure, found that although both reading-impaired and normal children profited by the manipulation, the relative superiority of normal readers' recall was maintained. Differences in the degree to which the experimental manipulations programmed the child's behavior may account for these differential results, since Torgeson was much more directive than Wong, et al., in requiring the child to engage in certain study behaviors and to produce a clustered recall. A question of interest in the present study was the relative impact of experimental manipulations on reading disabled and normal children.

Given that task manipulations can improve the amount recalled by reading impaired children, as both Torgeson (1977) and Wong, et al. (1977) have demonstrated, what mediating behaviors have been changed? Both Torgeson and Wong, et al. attribute the improved recall of their reading disabled groups to the increased used of organization prompted by the experimental manipulation. However, although Wong, et al. found greater use of recall organization with cuing instructions, this did not occur in a consistent fashion for the several conditions involved in the study, suggesting only a limited relationship between the use of category clustering and recall scores. In Torgeson's research, observations of the children's study behaviors during the experimental

trial showed that the manipulation changed the reading disabled children's study behaviors as well as their recall clustering. The most notable change was a decrease in the amount of time they spent distracted from the task. Wong, et al. did not find differences in the study behaviors of children in their instructed conditions, but they observed only a few such behaviors, not including the category "distracted", thus leaving somewhat indefinite the issue of what child behaviors are affected. Training designed to increase the child's use of organization in study and recall may affect other more general task strategies than organization, in particular, attention to the task, motivation, etc. Training studies done with reading disabled children have thus far not separated the effects of increased organization of items from the effects of increased task involvement. Both of these might contribute to the increased recall that has been reported as a result of training.

The present study attempted to separate the manipulation of use of semantic organization in study and recall from the influence of the amount of structure the task provides for the child's behavior during preparation for recall. In all conditions, children first received a baseline trial to evaluate their initial recall performance. On a second trial, three conditions were employed with equal numbers of reading disabled and normal children. Two of the conditions attempted to vary the "level of processing" of items (Craik & Lockhart, 1972). Following a method originated by Murphy and Brown (1975), children in one condition were required to categorize stimulus items on the basis of semantic similarity prior to study for recall (Semantic condition). In a second condition, children grouped the items on the basis of color (ignoring semantic relationships between items) prior to study for recall (Formal condition). Murphy and Brown (1975) used these two conditions

to vary the level of processing of items, with color sorting intended to produce a relatively superficial level of processing, while the semantic condition should produce a deeper level. If, as suggested by Craik and Lockhart (1972), the memory trace depends on the qualitative nature of the perceptual analysis carried out on the stimulus, the Semantic condition should produce better recall than the Formal condition. More importantly, if reading disabled children fail to demonstrate organization in recall as much as normal children due to a deficiency in the ability to generate effective organizational strategies, the Semantic condition should produce superior recall in those subjects by inducing them to organize items by category in recall. Whether the manipulation would be more effective for these children than for normal readers was also a question of interest, in light of the differential findings of Torgeson and Wong, et al., described above. The Formal condition was expected to decrease recall relative to baseline for normal readers by directing their attention away from semantic features and toward less helpful perceptual features of the items. Whether it would decrease recall and organization among the reading disabled would depend on the extent to which they spontaneously employed organization in the baseline condition; since previous studies suggest that they would be low in spontaneous organization, this condition was expected to have little effect on their recall performance as compared with baseline.

In a third condition, the Free Sort condition, children were instructed on their second trial to group the items into sets in any manner they chose that would be helpful for recall. Here, the level of processing and degree of organization of items for study were under the control of the child. Arrangement of items for study was not directed by instructions to the same

extent as in the other two conditions. This condition was used to assess the child's spontaneous approach to the sorting-study-recall task. It is similar to Torgeson's (1977) baseline condition and to Wong et al.'s (1977) no cue/timed condition. In line with their findings, we expected that reading disabled children would recall less well than normal children in this condition. Whether their lower recall would be attributable to the lesser use of organization in study and during recall was a question of major interest.

The present study employed only male children as subjects, because of practical problems involved in locating sufficient numbers of reading disabled female children in the school system. As learning disabilities are estimated to occur from three to ten times more frequently in boys than in girls (Bentzen, 1963; Owen, Adams, Forrest, Stolz, & Fisher, 1971), the results of the study should be generalizable to a substantial portion of the reading disabled population.

Method

Subjects

Ninety boys, 9 to 11 years of age, all 4th, 5th, or 6th graders enrolled in public schools in a large Southern city were selected to participate in the study. Forty-five of these were learning disabled children who were receiving special assistance in resource rooms at their schools. Each had been identified through the school system's formal psychological and educational assessments as having a learning disability. More specifically, these boys showed reading achievement test scores on the word recognition section of the Wide Range Achievement Test (Jastak, Bijou, & Jastak, 1965) that averaged 4.4 grades below actual grade placement. They had obtained intelligence test scores within the normal range on the Full Scale of the Wechsler Intelligence Scale for Children-Revised (Wechsler, 1974). Children with primarily sensory or emotional problems were excluded from the sample. The means, standard deviations, and ranges for reading grade level, IQ, and chronological age of the reading disabled group were as follows: For reading grade level, $\bar{X}$=1.61, SD=.72, range =1.0 - 3.7. For IQ, $\bar{X}$=93.06, SD=7.3, range = 85-120. For chronological age, $\bar{X}$=126.4, SD=8.17, range =110-143.

As controls, forty-five normal readers were randomly selected from the regular elementary school classes attended by the reading disabled boys. They were matched with the latter in age, grade level, race, and socioeconomic background. The mean chronological age for the normal group was 126.9 months (SD=9.0; range =110-140). The control subjects had no record of academic or adjustment problems and, according to school records, were reading at or above grade level. No information on intelligence test scores was available for these children.

Fifteen members of the reading disabled group were randomly assigned to

each experimental condition; each matched normal reader was then automatically assigned to the same condition as the reading disabled child with whom he was paired.

Materials

Items for the two recall trials consisted of 50 2 x 2 in. (5.1 x 5.1 cm) line drawings of common objects belonging to ten conceptual categories. The drawings were mounted on cardboard and covered by a sheet of colored plastic (EZ-Slide Report Covers) to produce items of five different colors. Color and conceptual category memberships were orthogonal, so that each of the five items representing a single category appeared on a different-colored card. Three sets of items were constructed, and used in a random fashion with different subjects, so that pairings of colors with particular sets of categories varied across subjects. The categories were Food, Winter Clothes, Vehicles, Animals, Furniture, Toys, School-related Tools, Eating Utensils, Personal Grooming Items, and Sporting Goods. Pretesting of the stimuli with 15 second-graders indicated that all items were easy to label and were familiar to the children, since all were able to give an appropriate name for each item.

Sets of cue cards were constructed to guide the children's grouping of items according to the procedure described below. For the Semantic condition, there were ten cards, each 8 x 10 in. (20.3 x 25.4 cm), representing a grocery store, stormy weather, a road, a zoo, a house, a playground, a classroom, a dinner table, a bathroom, and a stadium. For the Formal condition, blank cue cards of the same size were colored blue, yellow, gold, green, and red. For the Free Sort condition, five blank white cards, the same size as those used in the other conditions, were prepared.

Procedure.

Children were tested individually by a female experimenter in rooms at the schools. After attempting to make the child feel at ease, the experimenter invited him to play a memory game. All subjects received the same instructions on the baseline trial. Twenty-five items were placed face down on the table in an irregular circular arrangement, with no item adjacent to another of the same category or color. In an attempt to avoid list effects, each child received a randomly selected set of five categories (each containing five items) on this trial. His second trial was later given using the items from the five remaining conceptual categories and cue cards appropriate to the items and condition. For the baseline trial, the experimenter asked the child to name each picture as it was presented. The child was then given two minutes to study the items for recall. During this time, study behaviors were recorded according to the procedure described below. If the child indicated that he was ready to recall before the two-minute period elapsed, he was told to continue to study, and the time at which he made the request was recorded. After two minutes, the items were covered and the child was asked to recall the items. Recall continued for two minutes or until the child appeared to have been distracted for a period of 30 seconds. Items recalled and the order of recall were recorded.

After a brief interval during which the experimenter engaged in casual conversation with the child, a second trial was given, in which one of the three experimental conditions was presented. For the Semantic condition, the child was presented with five cue cards appropriate to the items to be presented on that trial. He was asked to label each of these, and then was instructed to label each of the 25 items as they were presented, and to sort them into sets

that belonged with each of the cue cards. The experimenter aided the child as necessary and recorded his sorting time. If the child had not finished sorting after three minutes, the experimenter gave direct instructions for category grouping. (This was necessary only for one reading-impaired child.) Then the experimenter asked the child to study the sorted items for recall. Study and recall measures were obtained in the same fashion as in the first trial.

For the Formal condition, the child was presented with the five colored cue cards together with the appropriate items. Following the same procedure as in the Semantic condition, the child was asked to name the colors of the cards, and then to name each item and sort it by color using the cue cards. None of the children needed assistance to sort correctly. Instructions for the two-minute study period and for recall were the same as for the Semantic condition; study and recall measures were obtained.

In the Free Sort condition, the test items were presented together with the five blank white cue cards. The experimenter pointed out the five cue cards, asked the child to label each item, and then instructed the child as follows: "Now, I want you to remember these pictures. You put them in these 'frames' any way you want to, any way that will help you to remember them." Parts of these instructions had to repeated for three reading disabled children. The experimenter recorded the grouping patterns used by the child and the time taken to sort. A three-minute time limit was used for sorting even if the child had not completed his item grouping (as was the case for one normal reader and one poor reader). Instructions for study and recall were the same as in the Semantic and Formal conditions, and data were recorded in the same fashion.

A checklist adapted from Moely, Olson, Halwes, and Flavell (1969) was used to record subjects' study behaviors during the stimulus-viewing period.

The study behaviors recorded in each 10-sec. interval were a) looking: following the stimulus array with eye movements; b) touching: any manual handling of the pictures; c) counting: counting verbally or on one's fingers; d) verbalizing: naming the pictures as evidenced by muttering, whispering, or clearly discernible lip movements; e) self-testing: looking away from the picture array or closing the eyes while attempting to repeat the items; and f) distracted: off-task behavior characterized by aimlessly looking around or investigating incidental aspects of the environment. During each of the twelve 10-second intervals, only one of the six categories could be scored, representing the predominant behavior during that interval. Each category thus could yield scores ranging from 0 to 12. Reliabilities for the looking, touching, self-testing, and distracted categories were obtained by comparing the ratings of two raters on twelve subjects. The reliabilities of the raters were .83, .83, .86, and .86 for these four categories, respectively. The categories counting and verbalizing occurred too infrequently in this group of children for a reliability estimate to be obtained, and these categories were therefore omitted from analyses reported below.

Results

Scores were obtained for the amount recalled and for recall organization. The measure of recall organization was the Ratio of Repetition (RR) (Bousfield, 1953), which has been evaluated favorably by Frender and Doubilet (1974). Various measures of the child's behavior during sorting and study for recall were also obtained. Unless otherwise indicated, analyses of variance performed on each measure included Groups (normal and poor readers) and Conditions (Semantic, Formal and Free Sort) as between-subjects variables and Trials (baseline and experimental) as a repeated measure.

Item Recall

Reading disabled and normal children differed significantly in total amount recalled, $F(1,84)=8.23$, $p<.01$, with normal readers remembering more items (Mean across both trials =13.56) than did the reading disabled ($\bar{X}=11.92$). A one-way analysis of variance of baseline recall scores indicated a significant difference between the normal and poor readers, $F(1,88)=5.82$, $p<.02$. Means and standard deviations for amount recalled are shown in Table 1.

Insert Table 1 about here

The analysis of variance of amount recalled also yielded a significant interaction of Conditions by Trials, $F(2,84)=18.25$, $p<.001$, reflecting a differential effect of Conditions, such that recall on the experimental trial in the Semantic and Free Sort conditions was notably increased over the baseline level, while in the Formal condition, little change from baseline was shown. Thus, the nature of the encoding task affected recall, as expected, yielding differences between the Semantic and Formal conditions. A significant

main effect of Conditions, $F(2;84)=4.54$, $p < .05$, is qualified by the interaction.

Although the normal group consistently recalled more items than the reading-disabled, no significant interaction of either Groups by Conditions or Groups by Conditions by Trials was obtained. Thus, it appears that the poor readers' reaction to the experimental manipulation was not quantitatively different form that of the normal readers in regard to amount recalled. As indicated in Table 1, however, the Semantic condition was effective in bringing the recall of the reading disabled up to the same level as that of the normal boys, which was not the case in the other two conditions.

Recall Organization

The analysis of variance of RR scores yielded a significant interaction of Groups by Conditions by Trials, $F(2,84)=3.57$, $p < .05$. The main effects of Conditions, $F(2,84)=13.63$, $p < .001$, and Trials, $F(1,84)=66.33$, $p < .001$, and the interaction of Conditions by Trials, $F(2,84)=16.05$, $p < .001$, were also significant. The three-way interaction was further analyzed by examining simple effects for each condition, using, in each case, an analysis of variance of Groups by Trials. In the Semantic condition, the analysis yielded a significant effect of Trials, $F(1,28)=61.36$, $p < .001$, reflecting an increase in clustering with semantic organization instructions for both normal and reading disabled children. As was the case for recall scores, the effect of the Semantic condition was to bring the reading disabled to approximately the same level of functioning as the normal children, although the statistical test does not indicate a greater effect of this condition on their organization scores than on those of the normal readers. In the Formal condition, no significant group difference or change over trials was found;

neither group was notably impaired or aided by the required use of color grouping. In the Free-Sort condition, a significant interaction of Groups by Trials was obtained, $F(1,28)=4.94$, $p < .05$, as well as a significant effect of Trials, $F(1,28)=39.18$, $p < .001$. As shown in Table 2, normal readers improved more from the baseline to the experimental trial in their use of organization than poor readers did. The three-way interaction, then, appears to reflect group differences in organization used in the Free Sort

Insert Table 2 about here

condition. When the child's grouping of items was controlled by the experimenter (in the Semantic and Formal conditions), no differences appeared between normal and poor readers in the effectiveness of the experimental manipulation.

If spontaneous use of organization is a problem for reading disabled children, as the finding for the Free Sort condition suggests, baseline clustering might show a group difference in organization as well. A one-way analysis of variance performed on baseline RR scores showed a tendency for lower scores among the reading disabled than in the normal readers, $F(1,88)=2.34$, $p = .12$. Correlations between RR and recall in the baseline period were .07 (ns) for the reading disabled and .28 ($p=.03$) for the normal readers. Thus, the poor readers tended to show less spontaneous use of category organization than normals did, and showed a lesser relationship between such organization and amount recalled.

An additional analysis was performed on the recalls of children in the Free Sort condition. Since subjects in this condition created their own grouping of the items during sorting, their use of some systematic but

idiosyncratic organizing system might not be reflected in RR scores. Therefore, idiosyncratic clustering scores were obtained for the ordering of recall by each child in this condition. Idiosyncratic recall organization refers to the child's use of his study period grouping as a way of ordering recall, regardless of the items' conceptual relations. Thus, if a child sorted "elephant" - "chair" together, even though these items do not share a category relationship, he would be scored as using idiosyncratic organization for the same items appearing as a set in his recall. RR scores for idiosyncratic organization were obtained for recalls made by children in the Free-Sort condition on the experimental trial. These were subjected to a one-way analysis of variance to test for group differences. The analysis showed that normal readers used their own organization in recall ($\bar{X}$=.49) to a greater extent than the reading disabled did ($\bar{X}$=.31), $F(1,28)=4.53$, $p < .05$. Thus, reading disabled children were less able than normals to use either category or idiosyncratic organization of items to order recall when the task required that they spontaneously generate their own system for grouping the items. When instructions provided them with a procedure for category grouping, the reading disabled were well able to use semantic organization in recall.

Study Behaviors

Behaviors observed during the study period were examined in order to determine whether poor readers were approaching the memory task in a different way than normals, and whether the three conditions induced observably different study behaviors.

First, the amount of time taken to sort items on the experimental trial was examined, using an analysis of variance that included Groups and Conditions

as between-subjects variables. A main effect of Conditions, $F(2,84)=36.2$, $p < .001$, reflects the lesser time required to sort in the Formal condition ($\bar{X}=58.1$ sec.) than in either the Semantic ($\bar{X}=128.5$) or Free Sort ($\bar{X}=120.1$) conditions. In light of differences in recall for the three conditions, described above, this finding suggests that there might be a relationship between the time taken to sort items and the amount recalled or organization used. In order to determine the influence of time taken to sort, independently of type of processing, correlations between sorting time, on the one hand, and either recall or clustering scores, on the other, were obtained for children in each condition. For the Semantic condition, time to sort correlated .05 with the number of items recalled and -.13 with clustering. For the Formal condition, correlations were -.05 and -.14. In the Free Sort condition, correlations were -.14 and .11. None of these correlation coefficients is statistically significant, and several show an inverse relationship between time and recall indices. Thus, using more time to group items did not significantly increase either the amount recalled or the extent to which items were organized for recall, according to within-condition comparisons. Differences between conditions in time to sort apparently reflect the difficulty of the sorting task children were required to carry out. The analysis failed to shown differences between normal and poor readers in the time taken to sort items for recall in any of the conditions.

Next, the kind of behaviors shown during the two-minute study period preceding recall were examined. An analysis of variance was performed on the scores for the latency until the subject said he was ready to recall, including Groups and Conditions as between-subjects variables, and Trials

as within-subjects variable. A significant effect of Trials, $F(1,84)=18.31$, $p < .001$, indicated that subjects used more of the study period to prepare for recall on the experimental trial than they had in the baseline trial. A main effect of Groups was almost significant, $F(1,84)=3.84$, $p=.05$, reflecting the tendency for reading disabled children to spend less time studying before indicating their readiness to recall than normal readers did.

Scores for the number of intervals during the study period in which the child showed distracted behavior were subjected to an analysis of variance including Groups and Conditions as between-subjects variables, and Trials as a within-subjects variable. A three-way interaction of these variables was obtained, $F(2,84)=3.14$, $p < .05$, as well as interactions of Groups by Conditions, $F(2,84)=5.55$, $p < .01$, and Groups by Trials, $F(1,84)=8.90$, $p < .01$.

Insert Table 3 about here

Mean scores are shown in Table 3. The three-way interaction was further analyzed by examining simple effects for conditions, using analyses of variance involving Groups and Trials as variables on scores obtained by children in each condition. For the Semantic condition, no significant effects of Groups or Trials were found, with children generally showing a low level of distraction. In the Formal condition, an interaction of Groups by Trials, $F(1,28)=9.20$, $p < .01$, reflects a decrease in distraction by normal readers on the experimental trial relative to baseline, and little change over trials for the reading disabled. As indicated in Table 3, the reading disabled children showed little distraction in either the Semantic or Formal conditions. For the Free Sort condition, a significant interaction of Groups by Trials, $F(1,28)=4.60$, $p < .05$, was due to an increase in dis-

traction among reading disabled children on the experimental trial, while normal readers showed little change from baseline. This analysis also yielded a significant effect of Group, $F(1,28)=5.33$, $p<.05$. It appears that the reading disabled were less able than normals to direct their attention to the stimuli during study time only in the Free Sort condition.

The three other study behaviors yielded less interesting findings. Self-Testing occurred infrequently, as indicated in Table 3, but showed a significant increase over Trials, $F(1,84)=7.33$, $p<.01$, as well as an interaction of Groups by Conditions by Trials, $F(2,84)=3.2$, $p<.05$. The interaction reflects the highest use of self-testing among the reading disabled children on the experimental trial in the Semantic condition. Looking at stimulus items showed a decrease over Trials, $F(1,84)=11.10$, $p<.01$, from a mean of 10.71 on the baseline trial to a mean of 9.36 on the experimental trial. Touching of stimulus items showed a low frequency of occurrence ($\bar{X}=.26$) and no differences between groups or conditions or across trials.

Finally, sorts of the items produced by the normal and poor readers in the Free Sort condition were scored for the use of category organization, using the RR index. This measure was used to indicate the extent to which the children used category relations between items as a basis for grouping. A one-way analysis of variance of these scores showed a significant difference between reading disabled and normal boys, $F(1,28)=7.48$, $p<.01$. Category organization was less often employed as a way of grouping items by the reading disabled ($\bar{X}=.31$) than by the normal readers ($\bar{X}=.53$).

Discussion

A basic question in the present investigation was the extent to which reading disabled children would spontaneoulsy use organization for recall relative to normal children. Results for the baseline trial indicated that the reading disabled recalled fewer items than normal readers did. This may be attributed in part to a lesser tendency to organize, since the poor readers tended to have lower RR scores on this trial than normals did. However, lack of organization cannot entirely account for the reading disabled children's recall deficit, since the group difference was not large. The lower correlation between RR and amount recalled for the reading disabled than for normals during baseline may reflect a lack of understanding of the use of organization as a strategy for recall. Although the reading disabled did not show more distracted behavior than normals during the baseline trial, their tendency to report readiness to recall early in the study period suggest that they had some difficulty in understanding the demands of the task.

A related finding was the effect obtained under the Free Sort condition, in which the children were required to impose their own organization when sorting items for recall. Several aspects of performance by the reading disabled suggest that they had difficulty in spontaneously developing a systematic approach to the memory task in this relatively unstructured situation. First, the poor readers did not use category clustering spontaneously in recall as much as normal children did; secondly, their use of semantic grouping of items in preparation for study was not as great as that shown by normal readers; and third, they did not generate an idiosyncratic form of organization to structure their study and recall as much as normals did. It appears that reading disabled children face difficulties when they

are required to generate their own strategies to meet task requirements. Explanations for this fact could be given either at a structural level, focusing on memory as a basic disability of these children, or at a behavioral level, emphasizing the child's failure to generate study behaviors appropriate to the task. Because reading disabled children made good use of organization for later recall under the condition that facilitated semantic grouping, a behavioral explanation seems more appropriate. The reading disabled subjects' performance in the Free Sort condition is best understood in terms of a failure to adapt productively to task requirements. Evidence from the study behavior measures supports this interpretation. The poor readers showed a higher level of distracted behavior under this condition than in any other condition. The unstructured setting characteristic of the Free Sort condition apparently was conducive to a decline in their task involvement. When faced with a task in which they must actively structure the situation, reading disabled children may fail because they have not learned to value individual, sustained, and organized effort directed toward the specified goal of the task. Researchers in the area of learning disabilities, while recognizing the possibility that specific deficits also exist, have begun to suggest that many of the performance deficits of learning disabled children are caused by general factors (e.g., motivation, anxiety state, etc.) that affect their level of performance in many different task settings (Torgeson, 1975).

When children were provided with an effective way to group items for study and recall (Semantic condition), the reading disabled were able to recall and organize their recalls as much as normal readers did. Means for recall and clustering shown in Tables 1 and 2 were nearly identical for the normal and poor readers in this condition, although the two groups did not

show a statistically significant differential increase in these indices as a function of semantic processing instructions. Thus, the poor readers' difficulty with the free recall task appears to reflect a "production deficiency" (Moely, 1977) for the use of semantic organization as a mnemonic strategy.

The contrasting effects of the Semantic and Formal conditions on performance of the reading disabled provide strong evidence for the importance of category organization as a strategy affecting recall. These two conditions were very similar in task demands--items were to be sorted in specified ways, then studied for two minutes prior to recall, etc., and the study behaviors shown in the two conditions were also very similar. No differences appeared in time spent distracted, looking at or touching items, or self-testing. Also, the amount of time that elapsed until the child indicated that he was ready to recall did not differ for these two conditions. Children in the Formal condition did take considerably less time to sort the items than those in the Semantic condition did, and it was suggested that time per se, rather than the kind of item processing required in the two tasks, might have affected recall. However, within-group correlations of the amount of time taken to sort and recall measures were consistently non-sigificant, justifying an argument against sorting time as the important variable differentiating the conditions. Thus, no obvious differences in behavior that might reflect the child's motivation, task involvement, or concentration during study were found between the Semantic and Formal conditions. The effects produced seem attributable only to the different kind of item processing required in the two conditions.

The Formal condition did not have the expected effect on normal children of lowering recall by decreasing the use of category organization. In fact,

recall was identical for normal children in this condition on baseline and experimental trials, and their use of organization decreased only very slightly. This may be due to their rather low use of category organization on the baseline trial. The finding that all children took longer before reporting readiness to recall on the experimental trial than they had on the baseline trial suggests that none of the groups was initially very sophistocated about the demands of the recall task. Since the normal readers' initial use of organization was not high, the Formal condition evoked little change.

There appears to be good reason to continue investigation of the use of strategies for information storage and retrieval as an explanation for some of the difficulties of the reading disabled child. In the present study, the manner in which the task was presented affected the use of memory capabilities by poor readers. Structural factors related to memory impairment did not appear to exist, at least for this kind of memory task, since poor readers' recall was notably improved by a manipulation that guided their use of category organization in study and recall. An important challenge for education becomes that of finding effective ways to engage the abilities that the reading disabled child has. The poor readers' study behavior in the classroom, as well as in structured task settings like that used here, may need to be firmly guided and supported by external sources in order to be effective.

Reference Note

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Table 1

Means and Standard Deviations for the Number of Items Recalled by Normal and Poor Readers in Each Condition on Baseline and Experimental Trials

		NORMAL READERS			POOR READERS	
Trial	Semantic	Formal	Free Sort	Semantic	Formal	Free Sort
Baseline	X =11.5	12.1	12.7	10.4	11.5	9.7
	S.D.=3.7	2.1	3.4	3.1	2.5	3.6
Experimental	X =16.4	12.1	16.4	16.5	10.7	12.7
	S.D.=3.5	3.2	2.9	3.9	3.2	4.0

Table 2

Means and Standard Deviations for Recall Organization (RR) by Normal and Poor Readers in Each Condition on Baseline and Experimental Trials

		NORMAL READERS			POOR READERS	
Trial	Semantic	Formal	Free Sort	Semantic	Formal	Free Sort
Baseline	X= .34	.35	.26	.26	.26	.29
	S.D.= .16	.14	.13	.14	.16	.13
Experimental	X= .63	.30	.55	.61	.34	.43
	S.D.= .11	.16	.15	.16	.15	.19

Table 3

Mean Frequency of Study Behaviors for Normal and Poor Readers in Each Condition on Baseline and Experimental Trials

		NORMAL READERS			POOR READERS		
Study Behaviors	Trial	Sem.	Formal	Free	Sem.	Formal	Free
Distracted	Baseline	.67	1.06	.40	.46	.13	.93
	Experimental	.60	.13	.13	.26	.33	1.80
Looking	Baseline	10.73	10.73	10.27	10.47	11.07	11.00
	Experimental	9.73	9.47	8.60	8.93	10.07	9.33
Touching	Baseline	.07	.00	.67	.07	.07	.00
	Experimental	.13	1.00	.13	.80	.07	.07
Self-Testing	Baseline	.00	.00	.00	.13	.00	.00
	Experimental	.00	.27	.67	.93	.20	.00